

Application No. 10/648,864
Response to Office Action

Customer No. 01933

Listing of Claims:

Claims 1-20 (Canceled).

21. (New) An optical switch comprising:

an electromagnetic driving mechanism which comprises: (a) a U-shaped magnetic core including two leg parts and an intermediate part between the two leg parts, (b) a coil wound on the U-shaped magnetic core, (c) a soft magnetic armature which includes two end portions respectively facing the two leg parts, and which is supported such that the armature is capable of making an oscillating motion, and (d) a permanent magnet provided to apply a magnetic flux to the U-shaped magnetic core and the armature;

at least one optical path switching unit directly fixed on the armature;

at least one incidence-side optical fiber for making light incident on the optical path switching unit; and

at least one emission-side optical fiber to receive light having an optical path switched by the optical path switching unit;

wherein the optical path switching unit comprises a first mirror, which is installed on the armature such that the first

Application No. 10/648,864
Response to Office Action

Customer No. 01933

20 mirror reflects light within a plane that is substantially
parallel to an oscillating direction of the armature.

22. (New) The optical switch as claimed in claim 21,
further comprising:

an incidence-side optical system for guiding the light from
the incidence-side optical fiber to the optical path switching
5 unit; and

an emission-side optical system for guiding the light having
the optical path thereof switched by the optical path switching
unit to the emission-side optical fiber.

23. (New) The optical switch as claimed in claim 21,
wherein the oscillating motion of the armature is a reciprocating
turning motion about a fulcrum position near a central portion of
the armature;

5 wherein the turning motion is generated by switching
between: (a) a magnetically attracting force that acts between a
first one of the leg parts of the U-shaped magnetic core and the
corresponding facing end portions of the armature, and (b) a
magnetically attracting force that acts between a second one of
10 the leg parts of the U-shaped magnetic core and the corresponding
facing end portion of the armature.

Application No. 10/648,864
Response to Office Action

Customer No. 01933

24. (New) The optical switch as claimed in claim 21, wherein the at least one optical path switching unit is provided near at least one of the two end portions of the armature.

25. (New) An optical switch comprising:

an electromagnetic driving mechanism which comprises: (a) a U-shaped magnetic core including two leg parts and an intermediate part between the two leg parts, (b) a coil wound on the U-shaped magnetic core, (c) a soft magnetic armature which includes two end portions respectively facing the two leg parts, and which is supported such that the armature is capable of making an oscillating motion, and (d) a permanent magnet provided to apply a magnetic flux to the U-shaped magnetic core and the armature;

at least one optical path switching unit directly fixed on the armature;

at least one incidence-side optical fiber for making light incident on the optical path switching unit; and

at least one emission-side optical fiber to receive light having an optical path switched by the optical path switching unit;

wherein the optical path switching unit comprises a transparent member, and the transparent member has a plane of light incidence and a plane of light emission which are

Application No. 10/648,864
Response to Office Action

Customer No. 01933

substantially parallel to each other and which are substantially parallel to an oscillating direction of the armature.

26. (New) The optical switch as claimed in claim 25, further comprising:

an incidence-side optical system for guiding the light from the incidence-side optical fiber to the optical path switching unit; and

an emission-side optical system for guiding the light having the optical path thereof switched by the optical path switching unit to the emission-side optical fiber.

27. (New) The optical switch as claimed in claim 25, wherein the oscillating motion of the armature is a reciprocating turning motion about a fulcrum position near a central portion of the armature;

5 wherein the turning motion is generated by switching between: (a) a magnetically attracting force that acts between a first one of the leg parts of the U-shaped magnetic core and the corresponding facing end portions of the armature, and (b) a magnetically attracting force that acts between a second one of
10 the leg parts of the U-shaped magnetic core and the corresponding facing end portion of the armature.

Application No. 10/648,864
Response to Office Action

Customer No. 01933

28. (New) The optical switch as claimed in claim 25, wherein the at least one optical path switching unit comprises two optical path switching units directly fixed on the armature.

29. (New) The optical switch as claimed in claim 25, wherein the transparent member has a rectangular flat shape.

30. (New) The optical switch as claimed in claim 25, wherein the at least one optical path switching unit is provided near at least one of the two end portions of the armature.

31. (New) The optical switch as claimed in claim 25, wherein at least one of the incidence-side optical fiber and the emission-side optical fiber is provided in plural numbers.

32. (New) The optical switch as claimed in claim 25, wherein the permanent magnet is arranged between the U-shaped magnetic core and the armature, such that a first magnetic pole end of the permanent magnet is positioned near a center of an intermediate part of the U-shaped magnetic core, while a second magnetic pole end of the permanent magnet is positioned near a fulcrum of the oscillating motion of the armature.

Application No. 10/648,864
Response to Office Action

Customer No. 01933

33. (New) The optical switch as claimed in claim 25,
wherein the permanent magnet comprises a composite permanent
magnet having a first magnetic pole on both ends thereof and a
second magnetic pole at a central portion thereof; and

5 wherein the permanent magnet is provided between the two leg
parts of the U-shaped magnetic core.

34. (New) The optical switch as claimed in claim 25,
wherein the permanent magnet is fixed to the armature such that a
first magnetic pole thereof is in contact with the armature, and
such that the permanent magnet oscillates together with the
armature.

35. (New) The optical switch as claimed in claim 25,
wherein the electromagnetic driving mechanism further comprises:

a fixed-side insulator base for integrally holding the
U-shaped magnetic core and the permanent magnet; and

5 a moving-side insulator for holding the armature; and

wherein the U-shaped magnetic core and the permanent magnet
are fixed by integral molding of the fixed-side insulator base,
with the permanent magnet being held in contact with a part of
the U-shaped magnetic core.

Application No. 10/648,864
Response to Office Action

Customer No. 01933

36. (New) The optical switch as claimed in claim 25,
wherein the electromagnetic driving mechanism further comprises:

a hinge spring part for supporting the armature while
applying one of an energizing force and a damping force to the
5 oscillating motion of the armature; and

a moving spring part interlocked with the oscillating motion
of the armature.

37. (New) An optical switch comprising:

an electromagnetic driving mechanism which comprises: (a) a
U-shaped magnetic core including two leg parts and an
intermediate part between the two leg parts, (b) a coil wound on
the U-shaped magnetic core, (c) a soft magnetic armature which
includes two end portions respectively facing the two leg parts,
and which is supported such that the armature is capable of
making an oscillating motion, and (d) a permanent magnet provided
to apply a magnetic flux to the U-shaped magnetic core and the
armature;

at least one optical path switching unit directly fixed on
the armature;

at least one incidence-side optical fiber for making light
incident on the optical path switching unit; and

Application No. 10/648,864
Response to Office Action

Customer No. 01933

at least one emission-side optical fiber to receive light having an optical path switched by the optical path switching unit;

wherein the optical path switching unit comprises a transparent member, and the transparent member has a plane of light incidence and a plane of light emission which are not parallel to each other and which are substantially parallel to an oscillating direction of the armature.

38. (New) The optical switch as claimed in claim 37, further comprising:

an incidence-side optical system for guiding the light from the incidence-side optical fiber to the optical path switching unit; and

an emission-side optical system for guiding the light having the optical path thereof switched by the optical path switching unit to the emission-side optical fiber.

39. (New) The optical switch as claimed in claim 37, wherein the oscillating motion of the armature is a reciprocating turning motion about a fulcrum position near a central portion of the armature;

wherein the turning motion is generated by switching between: (a) a magnetically attracting force that acts between a

Application No. 10/648,864
Response to Office Action

Customer No. 01933

10 first one of the leg parts of the U-shaped magnetic core and the corresponding facing end portions of the armature, and (b) a magnetically attracting force that acts between a second one of the leg parts of the U-shaped magnetic core and the corresponding facing end portion of the armature.

40. (New) The optical switch as claimed in claim 37, wherein the at least one optical path switching unit is provided near at least one of the two end portions of the armature.